

What is claimed is:

1. A process for preparing adiponitrile and methylglutaronitrile, characterized by the following process steps:
  - (a) reacting a reactant stream comprising pentenenitriles with hydrogen cyanide in the presence of at least one catalyst and of at least one promoter to obtain a reaction stream which comprises pentenenitriles, the at least one catalyst, catalyst degradation products, the at least one promoter, adiponitrile and methylglutaronitrile,
  - (b) distilling the reaction stream to obtain a stream 3 which is depleted in pentenenitriles and comprises the at least one catalyst, catalyst degradation products, the at least one promoter, adiponitrile and methylglutaronitrile as the bottom product, and a stream 4 enriched in pentenenitriles as the top product,
  - (c) extracting the stream 3 using an extractant present in stream 5 to obtain a stream 6 enriched with extractant as the top product which comprises the catalyst, and a stream 7 depleted in extractant as the bottom product which comprises catalyst degradation products, the at least one promoter, pentenenitriles, adiponitrile and methylglutaronitrile,
  - (d) distilling the stream 6 to obtain a stream 8 comprising the catalyst as the bottom product and a stream 9 comprising the extractant as the top product,
  - (e) distilling the stream 7 to obtain a stream 10 as the bottom product which comprises catalyst degradation products, the at least one promoter, pentenenitriles, adiponitrile and methylglutaronitrile, and a stream 11 comprising the extractant as the top product,
  - (f) distilling the stream 10 to obtain a stream 12 as the bottom product which comprises catalyst degradation products, the at least one promoter, adiponitrile and methylglutaronitrile, and a stream 13 comprising pentenenitriles as the top product,
  - (g) distilling the stream 12 to obtain a stream 14 as the bottom product which comprises catalyst degradation products and the at least one promoter, and a stream 15 as the top product which comprises adiponitrile and methylglutaronitrile,
  - (h) distilling the stream 15 to obtain a stream 16 comprising adiponitrile as the bottoms and a stream 17 comprising methylglutaronitrile as the top product.

2. The process according to claim 1, wherein the reactant stream stems from a homogeneous hydrocyanation of butadiene in the presence of a nickel(0) catalyst.
- 5 3. The process according to either of claims 1 or 2, wherein the stream 4 enriched in pentenenitriles comprises cis-2-pentenenitrile and (E)-2-methyl-2-butenitrile and is at least partly distilled to obtain a stream 18 depleted in cis-2-pentenenitrile and (E)-2-methyl-2-butenitrile, and a stream 19 enriched in cis-2-pentenenitrile and (E)-2-methyl-2-butenitrile.  
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4. The process according to any of claims 1 to 3, wherein stream 13 comprises cis-2-pentenenitrile and (E)-2-methyl-2-butenitrile and is distilled at least partly to obtain a stream 18 depleted in cis-2-pentenenitrile and (E)-2-methyl-2-butenitrile, and a stream 19 enriched in cis-2-pentenenitrile and (E)-2-methyl-2-butenitrile.  
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5. The process according to claim 3 or 4, wherein stream 18 is recycled at least partly into process step (a).
- 20 6. The process according to any of claims 1 to 5, wherein the extractant used is anhydrous.
7. The process according to any of claims 1 to 6, wherein stream 9 and/or stream 11 are recycled at least partly into process step (c).  
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8. The process according to any of claims 1 to 7, wherein process step (g) is performed as a two-stage distillation, by squeezing the stream 14 obtained in process step (g) in a subsequent process step (m) and diluting the squeezed stream 14 with at least a portion of the stream 17 obtained in process step (h) and comprising methylglutaronitrile.  
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9. The process according to any of claims 1 to 8, wherein the extractant is selected from the group consisting of cyclohexane, methylcyclohexane, n-hexane, n-heptane, isomeric C6, C7, C8, C9 cycloaliphatics, isomeric C6, C7, C8, C9 isoaliphatics, cis-, trans-decahydronaphthalene and mixtures thereof.  
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10. The process according to any of claims 1 to 9, wherein the stream 9 obtained in process step (d) contains less than 10% by weight of pentenenitriles.